WHAT IS CLAIMED IS:

1. A method for determining a pseudorange, and a rate of change thereof, to a beacon that transmits a signal including a plurality of blocks, each block including a plurality of frames of a pseudonoise sequence, each block being multiplied by a bit of a data sequence, the signal being shifted relative to a nominal frequency by a frequency shift, the method comprising the steps of:

(a) receiving the signal;

(b) digitizing said received signal, thereby producing a digitized signal including a plurality of bits;

(c) arranging said digitized signal as columns of an input matrix that includes a plurality of rows, each said column including consecutive said bits of said digitized signal that correspond to an integral number of frames of the pseudonoise sequence; and

(d) performing a discrete orthogonal transform on each said row of said input matrix, thereby producing a transformed matrix.

2. The method of claim 1, wherein said integral number is 1.

3. The method of claim 1, wherein said discrete orthogonal transform is a discrete Fourier transform.

4. The method of claim 1, wherein said transformed matrix includes a plurality of elements, the method further comprising the step of:

(e) multiplying each said element of said transformed matrix by a respective Doppler compensation factor.

5. The method of claim 4, further comprising the step of:

(f) providing an estimate of the frequency shift;

said Doppler compensation factors being based on said estimate of the frequency shift.

6. The method of claim 5, wherein said transformed matrix has fewer said columns than said input matrix, said estimate of the frequency shift being used to determine which said columns of said transformed matrix are produced by said discrete orthogonal transform.

7. The method of claim 4, further comprising the step of:

(f) convolving each said column of said transformed matrix with the pseudonoise sequence.

8. The method of claim 7, further comprising the step of:

(g) identifying at least one peak in said transformed matrix, each said at least one peak having a row coordinate and a column coordinate.

9. The method of claim 8, further comprising the step of:

(h) selecting, from among said at least one peak, a most likely peak, said row coordinate of said most likely peak then corresponding to the

pseudorange, and said column coordinate of said most likely peak then corresponding to the rate of change of the pseudorange.

10. The method of claim 8, wherein said receiving, said digitizing, said arranging, said performing, said multiplying, said convolving and said identifying are effected on a plurality of instances of the transmitted signal, the method further comprising the step of:

(h) inferring the pseudorange and the rate of change of the pseudorange from said row coordinates and said column coordinates.

11. The method of claim 10, wherein said inferring is effected using a track-before-detect identification scheme.

12. The method of claim 7, wherein said receiving, said digitizing, said arranging, said performing, said multiplying and said convolving are effected on a plurality of instances of the transmitted signal to produce a corresponding plurality of said transformed matrices, the method further comprising the steps of:

(h) integrating said transformed matrices non-coherently to produce a sum matrix; and

(i) identifying at least one peak in said sum matrix, each said at least one peak having a row coordinate and a column coordinate.

13. The method of claim 12, further comprising the step of:

(j) selecting, from among said at least one peak, a most likely peak, said row coordinate of said most likely peak then corresponding to the pseudorange, and said column coordinate of said most likely peak then corresponding to the rate of change of the pseudorange.

14. The method of claim 4, further comprising the step of:

(g) providing a plurality of estimates of the frequency shift, thereby producing, for each said element of said transformed matrix, a corresponding plurality of said respective Doppler compensation factors that are based on said estimates of the frequency shift;

and wherein said multiplying is effected separately for each said estimate of the frequency shift, thereby producing a corresponding plurality of Doppler-compensated matrices.

15. The method of claim 1, further comprising the step of:

(e) multiplying groups of said bits of said digitized signal, that correspond to the blocks of the transmitted signal, by respective bits of the data sequence, prior to said arranging of said digitized signal as columns of said input matrix.

16. A method for determining a pseudorange, and a rate of change thereof, to each of a plurality of beacons, each beacon transmitting a respective signal including a plurality of blocks, each block including a plurality of frames of a

pseudonoise sequence, each block being multiplied by a bit of a data sequence, the pseudonoise sequences and the data sequences being uniquely associated with respective satellites, all the pseudonoise sequences being of equal length, the pseudonoise sequences being mutually orthogonal, the method comprising the steps of:

(a) receiving the transmitted signals collectively as a received signal;

(b) digitizing said received signal, thereby producing a digitized signal including a plurality of bits; and

(c) for each beacon, multiplying groups of said bits of said digitized signal, that correspond to the blocks of the signal transmitted by said each beacon, by respective bits of the data sequence of said each beacon.

17. The method of claim 16, further comprising the steps of:

(d) for each beacon, arranging said digitized signal as columns of a corresponding instance of a first matrix that includes a plurality of rows, each said column including consecutive said bits of said digitized signal that correspond to an integral number of frames of the pseudonoise sequences; and

(e) for each beacon, performing a discrete orthogonal transform on each said row of said corresponding instance of said first matrix.

18. The method of claim 17, wherein each said instance of said first matrix includes a plurality of elements, the method further comprising the steps of, for each beacon:

(f) multiplying each said element of said corresponding instance of said first matrix by a respective Doppler compensation factor; and

(g) convolving each said column of said corresponding instance of said first matrix with said pseudonoise sequence of said each beacon.

19. The method of claim 18, further comprising the step of:

(h) for each beacon, identifying at least one peak in said corresponding instance of said first matrix, each said at least one peak having a row coordinate and a column coordinate.

20. The method of claim 19, further comprising the step of:

(i) for each beacon, selecting, from among said at least one peak, a most likely peak, said row coordinate of said most likely peak then corresponding to the pseudorange of said each beacon, and said column coordinate of said most likely peak then corresponding to the rate of change of the pseudorange of said each beacon.

21. The method of claim 20, wherein said receiving, said digitizing, said multiplying by respective bits of the data sequence, said arranging, said performing, said multiplying of said elements by said Doppler compensation factors, said convolving and said identifying are effected on a plurality of instances of the transmitted signal, the method further comprising the step of:

(j) for each beacon, inferring the pseudorange of said each beacon and the rate of change of the pseudorange of said each beacon from said row

coordinates and said column coordinates corresponding to said each beacon.

22. The method of claim 18, wherein said receiving, said digitizing, said multiplying by respective bits of the data sequence, said arranging, said performing, said multiplying of said elements by said Doppler compensation factors and said convolving are effected on a plurality of instances of the transmitted signal to produce, for each beacon, a corresponding plurality of said second matrices, the method further comprising the steps of: for each beacon:

(h) integrating said second matrices non-coherently to produce a sum matrix; and

(i) identifying at least one peak in said sum matrix, each said at least one peak having a row coordinate and a column coordinate.

23. The method of claim 22, further comprising the step of: for each beacon

(j) selecting, from among said at least one peak, a most likely peak, said row coordinate of said most likely peak then corresponding to the pseudorange, and said column coordinate of said most likely peak then corresponding to the rate of change of the pseudorange.

24. The method of claim 16, wherein said respective bits of said data sequences are common to all the beacons.

25. A receiver for receiving a signal transmitted by a beacon, the signal including a plurality of frames of a pseudonoise sequence, comprising:

(a) an antenna for receiving the transmitted signal;

(b) a mechanism for digitizing the received signal to produce a digitized signal including a plurality of bits;

(c) a memory for storing the digitized signal as columns of a matrix that includes a plurality of rows, each said column including consecutive said bits of said digitized signal that correspond to an integral number of frames of the pseudonoise sequence; and

(d) a processor for performing a discrete orthogonal transform on each of said rows of said matrix.

26. A locator system for locating a mobile unit, comprising:

(a) at least one beacon having a respective pseudonoise sequence and a respective data sequence, each said data sequence including a plurality of bits, each said at least one beacon operative to transmit a respective transmitted signal, each said respective transmitted signal including a plurality of blocks, each said block including a plurality of frames of said respective pseudonoise sequence, each said block being multiplied by a bit of said respective data sequence,

(b) a reference unit including:

(i) a reference unit receiver for:

(A) receiving said at least one transmitted signal as a reference unit received signal, and

(B) recovering said at least one data sequence from said respective reference unit received signal, and

(ii) a transmitter for transmitting said at least one data sequence to the at least one mobile unit; and

(c) in the mobile unit:

(i) a first mobile unit receiver for receiving said at least one data sequence, and

(ii) a second mobile unit receiver including:

(A) an antenna for receiving the at least one transmitted signal collectively as a mobile unit received signal,

(B) a mechanism for digitizing the mobile unit received signal to produce a digitized signal including a plurality of bits,

(C) a memory for storing, for each of the at least one beacon, an instance of said digitized signal, and

(D) a processor for multiplying each of said at least one instance of said digitized signal by said bits of said respective data sequence.

27. The locator system of claim 26, wherein each said at least one beacon is operative to move on a known respective trajectory while transmitting said respective transmitted signal.

28. The locator system of claim 26, wherein said processor is operative, for each of the at least one beacon, to arrange said corresponding instance of said digitized signal in said memory as columns of a matrix that includes a plurality of rows, each said column including consecutive said bits of said corresponding instance that correspond to an integral number of frames of said respective pseudonoise sequence, and to perform a discrete orthogonal transform on each of said rows of said matrix.

29. A method for determining a location of a receiver, comprising the steps of:

(a) providing a plurality of beacons having respective pseudonoise sequences, all said pseudonoise sequences being of equal length;

(b) transmitting, by each said beacon, a respective signal including a plurality of frames of said respective pseudonoise sequence;

(c) receiving said transmitted signals collectively as a received signal, by the receiver;

(d) inferring, for each beacon, a pseudorange and a rate of change of said pseudorange; and

(e) inferring the location of the receiver from said pseudoranges and from said rates of change of said pseudoranges.

30. The method of claim 29, wherein said inferring of said pseudoranges and said rates of change is effected by steps including:

(i) digitizing said received signal, thereby producing a digitized signal including a plurality of bits;

(ii) for each said beacon, arranging said digitized signal as columns of a matrix that includes a plurality of rows, each said column including consecutive said bits of said digitized signal that correspond to an integral number of said frames of said pseudonoise sequences; and

(iii) for each said beacon, performing a discrete orthogonal transform on each said row of said matrix.

31. A method for determining a pseudorange, and a rate of change thereof, to a beacon that transmits a signal including a plurality of blocks, each block including a plurality of frames of a pseudonoise sequence, each block being multiplied by a bit of a data sequence, the signal being shifted relative to a nominal frequency by a Doppler frequency shift, the method comprising the steps of:

(a) receiving the signal;

(b) digitizing said received signal, thereby producing a digitized signal including a plurality of bits; and

(c) applying a matched filter algorithm to said digitized signal to extract therefrom the pseudorange and the rate of change of the pseudorange, said matched filter algorithm including:

(i) demodulating said digitized signal relative to the data sequence.

32. The method of claim 31, further including the step of:

(d) aligning the bits of the data sequence with said digitized signal, prior to said demodulation.

33. The method of claim 32, wherein said aligning is within about one millisecond.

34. The method of claim 31, wherein said matched filter algorithm further includes:

(ii) arranging said digitized signal as columns of a matrix that includes a plurality of rows, each said column including consecutive said bits of said digitized signal that correspond to an integral number of frames of the pseudonoise sequence; and

(iii) performing a discrete orthogonal transform on each said row.

35. The method of claim 34, wherein said matrix includes a plurality of elements, and wherein said matched filter algorithm further includes:

(iv) multiplying each said element by a respective Doppler compensation factor.

36. The method of claim 35, wherein said matched filter algorithm further includes:

(v) convolving each said column with the pseudonoise sequence; and

(vi) identifying at least one peak in said matrix, each said at least one peak having a row coordinate and a column coordinate.

37. The method of claim 36, wherein said receiving, said digitizing, said arranging, said performing, said multiplying, said convolving and said identifying are effected on a plurality of instances of the transmitted signal, and wherein said matched filter algorithm further includes:

(vii) inferring the pseudorange and the rate of change of the pseudorange from said row coordinates and said column coordinates.

38. The method of claim 36, wherein said receiving, said digitizing, said arranging, said performing, said multiplying and said convolving are effected on a plurality of instances of the transmitted signal to produce a corresponding plurality of said matrices, and wherein said matched filter algorithm further includes:

(viii) integrating said matrices non-coherently to produce a sum matrix;

(ix) identifying at least one peak in said sum matrix, each said at least one peak having a row coordinate and a column coordinate; and

(x) selecting, from among said at least one peak, a most likely peak, said row coordinate of said most likely peak then corresponding to the pseudorange, and said column coordinate of said most likely peak then corresponding to the rate of change of the pseudorange.